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## Granite Characterisation and Chronology of the Archaeological Site of Touças (North of Portugal)

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Stones have been essential to protect humans from weather conditions since the beginning of humanity in escarpments, caves and other dwellings. In addition, they have been used as prehistoric tools, amulets, support for rock art and inscriptions of events or laws. They have also been used for the construction of houses, warehouses, pavements, dikes, funerary monuments and sanctuaries. Foundation stones are laid at the moment when construction of the building or structure that they support starts. The dating of this moment provides useful information about the past history of human activities.

The archaeological site of Touças is located 500 meters to the northeast of Garganta village, in São Martinho de Anta, municipality of Sabrosa (North of Portugal). It consists of about 70 standing stones of granite, several granite sarcophagi, a twin carved grave in the outcropping granite, historical quarries, a well-preserved landmark of Malta military order. In addition, a historical document indicates the previous existence of a chapel in this site.

Fieldwork was carried out to determine the type of building stones used at the archaeological site. Building granite has been identified and sampled for an in-depth analytical study. Two thin sections were prepared and characterised under a Leica DM-4500-P polarisation microscope equipped with a Leica DFC290-HD digital camera and LAS-4.9 software. Eight cubic samples with dimensions of  $5 \times 5 \times 5 \pm 0.5$  cm were tested for the petrophysical characterisation of the granite (effective porosity, water absorption and bulk density) using the Natural Stone Test Method described in European standard UNE-EN 1936. Ultrasonic pulse velocity of the granite cubes was taken with a CNS Electronics PUNDIT equipment following European standard UNE-EN 14579.

Optically stimulated luminescence (OSL) was applied to the granite foundation stones of the standing stones, sarcophagi, and walls to determine their chronology. This was done by measuring the OSL signal of the surface layer of buried granite stones. The sampling was performed at night, under red light. In the lab, slides of 5 mm layer from each stone surface was removed by sawing with a diamond-impregnated wheel. The samples were crushed in a vice and crystals with a diameter in the range of 90-250  $\mu$ m were extracted by sieving. All measurements were taken with an automated Risø TL/OSL-DA15 reader and a Lexsyg Research device.

The main building granite of the archaeological site is a coarse-crystal-size granite with elongated pseudo-oriented feldspars. This building granite is the same as the outcropping granite, where there is a historical quarry.

OSL dating can be applied to obtain the absolute age from the burial of stones containing quartz. The archaeological excavations carried out in 2020 revealed that the standing stones may predate the use of the site as a medieval necropolis. The foundations of a wall that could belong to the Hermes chapel have also been found.

This archaeological site presents extremely relevant evidence for the understanding of human occupation in Trás-os-Montes e Alto Douro territory.

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